10 E 104

WIN-TRONIX

INSTRUCTION HANDBOOK

COPYRIGHT 1955
WINSTON ELECTRONICS, INC.

for

J 508

DYNAMIC SWEEP CIRCUIT ANALYZER

MODEL 820

WINSTON ELECTRONICS
DIVISION OF JETRONIC INDUSTRIES
4000 N.W. 28th STREET
MIAMI 42, FLORIDA

WINSTON ELECTRONICS, INC.
4312 MAIN STREET, PHILADELPHIA 27, PA.

WINSTON ELECTRONICS, INC.

TABLE OF CONTENTS

		PAGE NO.
I	GENERAL	1
II	FRONT PANEL CONTROLS	2
III	SPECIFICATIONS	3
IV	OPERATION AND TROUBLESHOOTING WITH MODEL 820	3
V	HORIZONTAL SWEEP CIRCUIT TROUBLESHOOTING BY SIGNAL SUBSTITUTION	3
VI	HORIZONTAL FLYBACK TRANSFORMER TESTING	6
VII	DEFLECTION YOKE TESTING	6
VIII	VERTICAL TROUBLESHOOTING BY SIGNAL SUBSTITUTION	7
IX	SYNC CIRCUIT TROUBLESHOOTING	8
X	COMBINED SUBSTITUTION OF BOTH VERTICAL AND HORIZONTAL DRIVES	9
XI	FLYBACK TRANSFORMER AND YOKE TESTING, GENERAL	9
XII	SHORTED TURN TEST FOR FLYBACK TRANSFORMERS	10
XIII	SHORTED TURN TEST FOR DEFLECTION YOKES - COLOR OR BL. & WH	11
XIV	CONTINUITY TEST FOR FLYBACK TRANSFORMERS AND YOKES	12
XV	LEAKAGE TESTING OF TRANSFORMERS AND YOKES	13
XVI	CONTINUITY TESTING OF COILS, TRANSFORMERS, SPEAKERS, RESISTORS, VACUUM TUBE FILAMENTS AND AC-DC FILAMENT STRINGS	13
XVII	ADDITIONAL FEATURES	13
XVIII	MAINTENANCE OF DYNAMIC SWEEP CIRCUIT ANALYZER	14
	FIGURES 1 THROUGH 6	15
	SCHEMATIC DIAGRAM	18
	PARTS LIST	19

MODEL 820

DYNAMIC SWEEP CIRCUIT ANALYZER

I - GENERAL

Model 820 Dynamic Sweep Circuit Analyzer has been designed to facilitate the trouble shooting and repair of TV deflection circuits. It provides accurate positive answers to deflection circuit service problems, of the following character:

Vertical: Is the trouble in the -
Vertical Oscillator,
Vertical Output,
Deflection Yoke or Transformer?

Horizontal: Is the trouble in the -
Horizontal Output Tube Circuit,
Horizontal Oscillator,
Damper Tube Circuit,
Horizontal Flyback Transformer,
Deflection Yoke,
or Picture Tube?

Sync Circuits:

Vertical: Will a 60 cps sync pulse injected into the input of the sync amplifier, vertical integrating circuit or at the grid of the vertical oscillator produce vertical synchronization?

Horizontal: Will a 15 kilocycle sync pulse injected into the input of the horizontal sync amplifier, the input to the horizontal AFC tubes or AFC circuit produce horizontal synchronization?

Model 820 provides these answers by the time tested technique of SIGNAL SUBSTITUTION at KEY TEST POINTS; it is actually two instruments in one.

a. A Horizontal and Vertical Sawtooth and Square Wave Generator for sweep circuit signals.
b. A Complete, highly sensitive Flyback Transformer and Deflection Yoke Tester which indicates the quality of the component under test, at a glance, on an oscillating neon indicator.

II - FRONT PANEL CONTROLS

FUNCTION Switch provides the following selector positions:
POWER - ON/OFF
SIGNAL SUBSTITUTE (Simultaneous generation of 60 cps Vertical and 15 KC horizontal deflection voltages)
CONTINUITY TEST (Flybacks and Yokes)
SHORT TEST (Flybacks and Yokes)

TYPE SWITCH:
provides the following selection of component test when the FUNCTION switch is in CONTINUITY or SHORT test positions:
CALIBRATE
IRON CORE FLYBACK (Black & White or Color)
AIR CORE FLYBACK (Black & White or Color)
BLACK & WHITE YOKES (Horizontal & Vertical Coils)
COLOR YOKES (Horizontal and Vertical Coils)

CAL-FREQ CONTROL:
a potentiometer which is used to -
1- Accurately calibrate the oscillating neon indicator before tests of Flybacks and Yokes.
2- Provide adjustment of the horizontal sawtooth deflection frequency. Its action is similar to the Horizontal HOLD control of TV receivers.

TEST JACKS AND OUTPUT CONNECTORS:
1- TEST and GND jacks - used to connect flyback transformers, deflection yokes and other components for CONTINUITY and SHORT test.
2- VERT DRIVE and GND jacks - output source for 60 cps vertical sawtooth.
3- GRID DRIVE (horizontal) and GND - output source for 15 KC grid drive.
4- XFMR DRIVE (horizontal) and GND - output source for 15 KC output transformer drive.

INDICATORS:
1- Oscillating Neon Indicator - with its D.C. amplifier, it is more sensitive than a meter. This high degree of sensitivity is required to locate "one turn shorts" in flybacks or yokes.

2- Overload Indicator - glows dimly when driving the horizontal output transformer directly with normal circuit operation - glows brightly under overload conditions and will burn out under extreme overload such as might damage components. The No. 44 pilot light is replaceable from the front.
3- Pilot lamp glows under application of power to Model 820.

III - SPECIFICATIONS

Signal Outputs
1- 15734 cps sawtooth adjustable
2- 15734 cps square wave adjustable
3- 60 cps wave locked to line
Overload indicator for safety
Oscillating Neon Indicator with D.C. amplifier for Flyback/Yoke tests
Calibrated for COLOR and BLACK and WHITE
Test Leads Supplied
Operates on 105-125V, 60 cps
Size 10 1/2 x 7 x 6
Weight 7-3/4 lbs

IV - OPERATION AND TROUBLESHOOTING WITH MODEL 820

The order of tests given are considered the most logical with the less difficult tests considered first. If a definite deflection stage is suspected, however, it may be preferable to analyze it at once.

Model 820 provides SIGNAL SUBSTITUTION as the means for troubleshooting. The vertical and horizontal wave forms are available simultaneously at the panel test jacks when the FUNCTION SWITCH is placed in the SIGNAL SUBSTITUTION position.

V - HORIZONTAL SWEEP CIRCUIT TROUBLESHOOTING BY SIGNAL SUBSTITUTION

Before starting the horizontal signal substitution test, the high voltage of the receiver should be checked. The WIN-TRONIX HI-VOLTAGE THERMOMETER MODEL 900 is ideal for this

application. If it is within 20% of specified value, it may not be necessary to signal substitute. Check the beam bender, picture tube socket connections, brightness control and picture tube. KEEP THE HIGH VOLTAGE METER CONNECTED DURING THESE TESTS. In a situation where there is no raster, no high voltage or a weak raster, proceed as follows:

a. HORIZONTAL GRID DRIVE SUBSTITUTION.
   1- Remove power from TV receiver.
   2- Energize Model 820 from power lines.
   3- Disconnect grid coupling condensor from horizontal output tube grid. See Figure 1.
   4- Connect ground lead from Model 820 to B minus of the receiver horizontal output circuit.
   CAUTION: This is not necessarily the chassis ground. Some receivers use a floating B minus for the horizontal output; the Model 820 ground must be connected to this B minus to avoid possible blowout of fuses when making the output test. Refer to Figure 1.
   5- Connect test lead from Horizontal GRID DRIVE jack of Model 820 to the grid pin of horizontal output tube in TV receiver. At this point it will be assumed that the High Voltage Tubes have been checked and the High Voltage hookup visually inspected for obvious defects. Check the appearance of high voltage resistors in this circuit.
   6- Energize the TV receiver and allow a 30 second warm up period.

DIAGNOSIS BY RESULTS OF THIS TEST If a raster now appears, the test indicates trouble in the horizontal oscillator. If the trouble still exists as stated, the test indicates the location of the deficiency is in the horizontal output section and analysis with Model 820 should continue.

b. HORIZONTAL OUTPUT TRANSFORMER DRIVE SUBSTITUTION.
   1- De-energize TV receiver. Model 820 may still be on.
   2- Remove the plate cap from the horizontal output tube (if it is suspected that there may be a screen

grid short then remove the tube also.) See Figure 2.

3- Connect ground lead of Model 820 to B minus on the receiver horizontal output circuit. CAUTION: This is not necessarily the chassis ground. Some receivers use a floating B minus for the horizontal output; the Model 820 ground must be connected to this B minus to avoid possible blowout of fuses when making the output test. See Figure 2.

4- Connect a test lead from XFMR DRIVE jack on Model 820 to the plate cap lead (removed from the output tube) which connects to the horizontal output transformer. Use of unnecessarily long leads can produce spurious oscillation. CAUTION: Do not handle this test lead when receiver is turned on, as it may carry approximately 3000 volts pulse. No danger exists when receiver is off since Model 820 only draws B plus from XFMR DRIVE when the receiver is energized.

5- Turn on TV receiver and allow 30 seconds warm up.

DIAGNOSIS BY RESULTS OF THIS TEST
If a raster now appears, the trouble has been analyzed to the horizontal output tube circuit. If the trouble still persists measure the B plus to the horizontal transformer circuit and check the damper tube. If these tests show negative continue with the analysis.

NOTE: At this point it is possible to have horizontal output voltage with no raster. This may occur if the HV rectifier circuit is defective. Exercising due caution, a 1/4 to 1/2 inch arc may be drawn off the plate of the HV rectifier if the horizontal output circuit is operating.

The Model 820 may not produce more than 60% of high voltage values given in the receiver manufacturers specifications. Experience will show what results can be expected on receivers with different kinescope sizes.

c. USE OF THE OVERLOAD INDICATOR.

When driving the horizontal output transformer from the XFMR DRIVE jack the overload indicator can be used as a means of locating shorted components in the horizontal output circuit. If the indicator becomes abnormally bright, turn the receiver off before damage can result. Disconnect components in the horizontal output circuit which are not absolutely necessary for the production of deflection and high voltage. Turn on the receiver each time and repeat the test to see if the shorted condition has been removed. These components normally include such items as the width coil, condenser across the width coil, condenser-resistor combinations across the horizontal winding of the deflection yoke, gated AGC connections to the flyback, etc. Familiarity with the function of the other components will permit extension of this technique for an even greater saving of time.

If a fuse in the B plus of the horizontal output blows each time tests are attempted, this fuse may be jumped and the Overload Indicator used as a fuse. Do not leave the receiver on for more than 30 to 60 seconds when using this arrangement.

VI - HORIZONTAL FLYBACK TRANSFORMER TESTING

Remove the receiver power cord from the AC line and proceed with the transformer test as described later in the handbook.

DIAGNOSIS BY RESULTS OF THIS TEST
If the flyback tests bad then the trouble has been located. If it tests good then the test indicates that the trouble is located between the flyback and the picture tube.

VII - DEFLECTION YOKE TESTING

Remove power from TV receiver and proceed with yoke tests as described later in the handbook.

DIAGNOSIS BY RESULTS OF THIS TEST
If the yoke coils test bad the trouble has been located. If it tests good then the test indicates that the horizontal output circuit or the picture tube is the source of the trouble.

VIII - VERTICAL TROUBLESHOOTING BY SIGNAL SUBSTITUTION

If a horizontal white line is the only deflection or if only a small amount of vertical deflection is produced, proceed with the following tests.

a. VERTICAL GRID DRIVE.
1- Disconnect the vertical output grid coupling condenser. See Figure 3.
2- Connect ground lead of Model 820 to B minus of the receiver and connect the red test lead from VERT DRIVE jack through the grid coupling condenser. If this does not produce vertical deflection connect directly to the grid pin of the vertical output tube (coupling condenser disconnected on one end).

DIAGNOSIS OF RESULTS OF THIS TEST
With the receiver turned on:
1- If vertical deflection now appears the trouble as indicated by the test is in the vertical oscillator.
2- If the trouble still exists, the test indicates that it is in the output stage or yoke coil.

b. VERTICAL DEFLECTION YOKE COIL.
The next logical step is to test the Vertical Deflection Yoke coil in a manner described in the section on DEFLECTION YOKE TESTING.

NOTE: The vertical deflection produced by Model 820 is not linear. The center of the raster will normally be stretched and compression or squeezing will be observed at the top and bottom of the raster. Model 820

is intended to serve as a circuit analyzer and not a linearity tester.

IX - SYNC CIRCUIT TROUBLESHOOTING

Considerable time can be saved in locating sync troubles if a sync pulse can be injected into various points of the sync chain. Adapters can be constructed to convert the sawtooth outputs into sync pulses for signal substitution. See Figure 4. These adapters are also available as a set upon request from the factory at nominal cost. Order as Models 915 and 960.

a. VERTICAL SYNC.

In cases where the vertical sync is lost or the picture rolls, the pulse derived from the vertical sync adapter may be injected along the sync chain to localize the circuit through which sync cannot pass. Observing correct polarity of sync injection is important. See Figure 4 and refer to receiver manufacturer's schematic.

Examples of sync test points are:

1- Vertical Oscillator Grid (through a 1 meg resistor in series with the test lead.)
2- Vertical Oscillator side of Vertical integrating circuit.
3- Input side of vertical integrating circuit.
4- Output of Vertical Sync Amplifier.
5- Input of Vertical Sync Amplifier.
6- Output of Sync Separator.
7- Input of Sync Separator.
8- Video Test Point.

b. HORIZONTAL SYNC.

Figure 4 also shows an adapter which can be constructed or purchased at nominal cost from the factory for producing a horizontal sync pulse. Only negative pulses are produced by this circuit and the signal should only be injected at those points in the receiver which carry negative sync. As is known, the sync pulse polarity reverses as sync travels through the sync amplifiers in the receiver.

A positive sync pulse could be obtained by passing the negative pulse through a small one tube amplifier.
Examples of test points for injection of this pulse are as follows:

1- Grid of Horizontal Oscillator. (Modern oscillator control circuits do not actually operate with a sync pulse on the grid as they are normally controlled by a D.C. bias applied to the grid.)
2- Sync Input to the Oscillator control tube (AFC or "Phase Comparer").
3- Output of Sync Amplifier.
4- Input of Sync Amplifier.
5- Output of Sync Separator.
6- Input of Sync Separator.
7- Video Test Point.

X - COMBINED SUBSTITUTION OF BOTH VERTICAL AND HORIZONTAL DRIVES

Model 820 can provide simultaneously to the TV receiver, both the vertical and horizontal outputs. When the receiver grids are driven in this manner the results are the same as when driving either one alone (assuming one deflection circuit operative.) This technique will normally produce a full raster. However, if the vertical grid and the horizontal transformer drive are used at the same time, height of the raster will be about 1/4 to 1/3 of full deflection for normal operation.

XI - FLYBACK TRANSFORMER AND YOKE TESTING, GENERAL

The horizontal flyback transformer or deflection yoke of a TV receiver may be defective, and yet, look perfectly normal. The usual trouble found with the defective components will be one, or a few, shorted turns which are caused by the high voltage breakdowns across the windings and which ordinary resistance tests cannot detect. Since it is time consuming and expensive to replace these components, only to discover that some associated part in the output circuit was causing the trouble. The component should be tested while in the receiver to determine its quality with

Model 820.

THREE TESTS ARE REQUIRED TO DETERMINE THE CONDITION OF FLYBACKS AND YOKES:
1- Shorted turn test;
2- Continuity test (for open windings):
3- Leakage test between separate windings or from windings to the core.
NOTE: If any one of the three tests shows bad, the component must be judged defective.

XII - SHORTED TURN TEST FOR FLYBACK TRANSFORMERS

The various kinds of flyback transformers should be tested in the positions of the TYPE switch as indicated below:

1- Ceramic Core Flybacks: Use the IRON CORE FLYBACKS position of the TYPE switch;
2- Laminated Iron Core Flybacks: This type is now obsolete but may be tested in the BL. & WH. YOKES position of the TYPE switch;
3- Air Core Flybacks (including the type with an iron slug): Use the AIR CORE FLYBACKS position of the TYPE switch.

a. Connect Model 820 to 110 VAC power source and allow a one minute warm up.
b. Connect factory supplied test leads to TEST jack on Model 820. DO NOT CONNECT COMPONENT UNDER TEST.
c. Rotate FUNCTION Switch to SHORT TEST position.
d. Rotate TYPE Switch to CALIBRATE position.
e. Adjust CALIBRATE control to point where neon indicator will just begin to flicker slowly but steadily. (This must be done with the test leads open at the end and not connected to component).
f. Remove from TV receiver:
   1- All high voltage rectifiers and damper tubes;
   2- Deflection yoke cable plug or unsolder the hot lead of the horizontal yoke coil;
   3- Plate lead of horizontal output tube;

4- One lead of Width Coil - this will remove width coil from transformer circuit so that it can be checked separately.

g. Rotate TYPE switch to the type of flyback transformer which is being tested. NOTE: Select the position according to the instructions given for the three general types listed above.

h. Connect test leads to high voltage boost winding of flyback. RED LEAD to high voltage connection (cap removed from the H.V. Rectifier). BLACK LEAD to the driver plate cap connector (remove from the horizontal output tube). See Figure 5.

i. If neon indicator continues to glow or flicker the component is not shorted and should now be checked for continuity and leakage; if the indicator is extinguished the flyback should be judged as BAD. Repeat adjustments when in doubt.

NOTE: TESTING SPECIAL TYPES OF FLYBACKS

Type 1- Air core flybacks consisting of two separate PYE sections and an iron slug, RCA stock number 76501, or replacement equivalents, connect test leads to the two wires at the ends of the coils.

Type 2- Stancor A-8119 and similar replacements which use a very small high voltage boost winding (due to the high Q ceramic core): A correct SHORTED TURN TEST can be made by connecting the test leads to the H.V. rectifier plated lead and the bottom end of the primary (instead of the horizontal output plate lead). On the Stancor A-8119 these connections are numbered 3 and 1.

XIII - SHORTED TURN TEST FOR DEFLECTION YOKES - COLOR OR BL. & WH.

The various kinds of deflection yokes should be tested in the positions of the TYPE switch as indicated below:

1- 3 Milli-Henrys to 15 Milli-Henrys, inclusive: Use the BL. & WH. YOKES position of the TYPE Switch.

2- 16 Milli-Henrys and higher: Use the COLOR YOKES position of the TYPE switch. Color TV yokes are currently designed with high impedance windings having high Q's and will normally fall in the "16 Milli-Henrys and higher" class.

NOTE: Although all yokes for BL. & WH. position of the TYPE switch, it is best to observe the above classification whenever possible.

a. Repeat the set up procedure as listed in steps "a" to "e" under flyback transformer shorted turn test.
b. Remove all power from the TV receiver.
c. Unplug the yoke to be tested or disconnect the "hot" horizontal and vertical leads.
d. Rotate the TYPE switch to yoke type being tested (Color or Bl. and Wh.).
e. Connect test leads to the HORIZONTAL deflection yoke coil across the terminal points on the yoke or at the plug end of the yoke cable. See Figure 6.
f. If the neon indicator continues to glow or flicker the winding is NOT SHORTED. If the neon indicator is extinguished, the winding has a short circuit.
g. Now connect test leads to the Vertical deflection coil across the terminal points on the yoke or at the plug end of the yoke cable AFTER FIRST DISCONNECTING ONE SIDE OF ALL DAMPING RESISTORS CONNECTED TO THIS WINDING. See Figure 6.
h. If the neon indicator continues to glow or flicker the winding is GOOD (i.e., not shorted). If the neon indicator is extinguished, the winding is SHORTED.

CONTINUITY TEST FOR FLYBACK TRANSFORMERS AND YOKES

After completion of the short test make the continuity as follows:

a. Rotate FUNCTION Switch to CONTINUITY.
b. Rotate TYPE Switch to CALIBRATE.
c. Turn CAL-FREQ control to maximum clockwise (to make the indicator glow when test leads are shorted).
d. Connect test leads across each winding successively. If the neon indicator glows, the winding is CONTINUOUS. If the neon indicator will NOT glow the winding

is OPEN.

e. As a further check on calibration of the Model 820 for continuity test, the neon indicator should glow when its own test leads are shorted with the controls set as in "a" to "c".

XV - LEAKAGE TESTING OF TRANSFORMERS AND YOKES

Transformers, yokes and coils may become defective due to excessive leakage developed between windings not connected together or from windings to the core.

As a flyback and yoke tester the Model 820 is unique in that it will also check leakage up to 300 million ohms. With the FUNCTION switch set in CONTINUITY position and the CAL-FREQ control in maximum clockwise, the neon indicator will flash once in approximately 6 seconds for 300 million ohms or once each second for 50 megohms. A rough check on leakage can be found by multiplying the number of seconds between flashes by 50. For example, if the light flashes once in 3 seconds the leakage resistance is 3 X 50 or approximately 150 ohms.

In checking flybacks and yokes for leakage the test leads are connected between the separate windings which have no internal connection. In the case of the yoke the test would be made between the vertical and horizontal yoke coils. Test for leakage to the core should also be made on transformers and yokes before they are judged good.

A good transformer or deflection yoke should not show any leakage. This means that the neon lamp should not flicker at all when a good transformer or yoke is tested for leakage.

XVI - CONTINUITY TESTING OF COILS, TRANSFORMERS, SPEAKERS, RESISTORS, VACUUM TUBE FILAMENTS AND SERIES FILAMENT STRINGS may also be made by using the Model 820 as described under the subject of CONTINUITY TESTS.

XVII - ADDITIONAL FEATURES

The Flyback and Yoke section of the Model 820 is a component checker. As is the case with all component checkers, there

can be exceptions which the unit will not test. Experience with the Model 820 in the field has shown its usefulness and dependability to be far greater than that of the typical component checker. In the case of an intermittent flyback or yoke, or one which becomes bad only when subjected to the high pulse voltages in the TV receiver, the component may lose the defect as soon as the pulse voltage is removed. Therefore, such a flyback or yoke will test good in a component checker since the breakdown or intermittent disappeared as soon as the TV receiver was turned off.

This problem can be overcome by use of the Signal Substitution feature of the Model 820 to locate these intermittents by actually applying a horizontal drive directly to the transformer in the operating TV circuit. This function of the Analyzer should be used on a transformer in TV circuit before resorting to flyback and yoke tests. See Figure 2. The USE OF THE OVERLOAD INDICATOR will be very valuable in locating trouble in the transformer output circuit. See item V, c, 6.

XVIII - MAINTENANCE OF DYNAMIC SWEEP CIRCUIT ANALYZER

The WIN-TRONIX Model 820 Dynamic Sweep Circuit Analyzer has been constructed of the highest quality electronic components which will normally provide trouble free operation for prolonged periods of use. In the event, however, that failure of operation is observed after carefully following the operation instructions in this manual, it is recommended that the unit be returned to the factory after receiving written authorization so that advantage may be taken of the warranty.

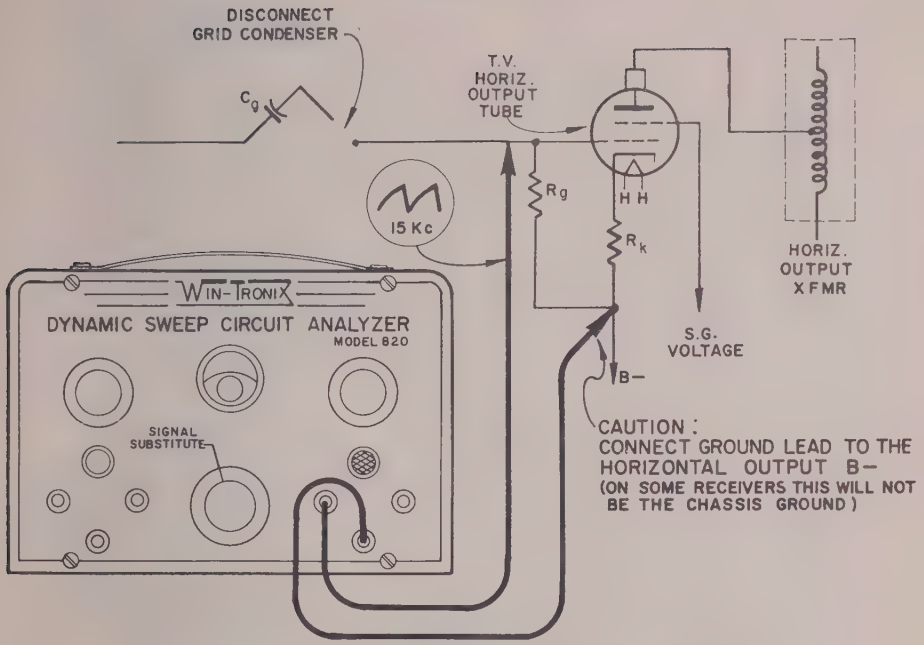


FIG. 1 HOOKUP FOR INJECTING A 15Kc SAWTOOTH ON THE HORIZONTAL OUTPUT TUBE GRID.

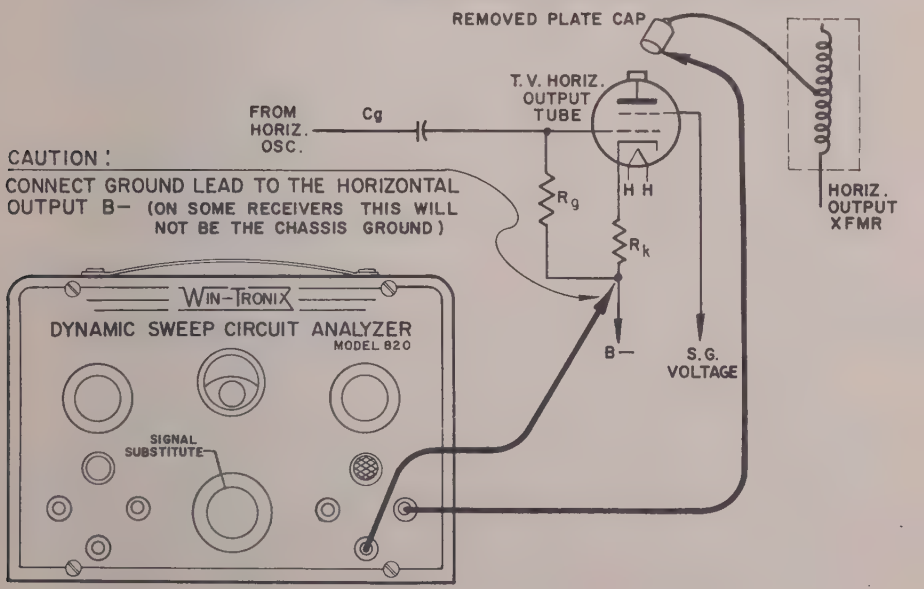


FIG. 2 HOOKUP FOR DIRECT DRIVE OF HORIZONTAL OUTPUT TRANSFORMER BY THE MODEL 820.

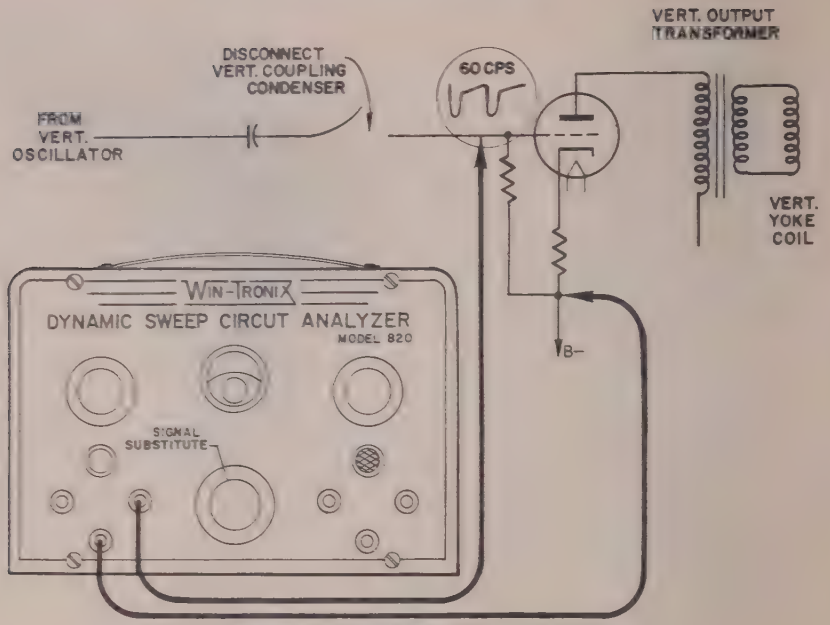


FIG.3 HOOKUP FOR INJECTING 60 CPS SIGNAL ON VERTICAL OUTPUT GRID.

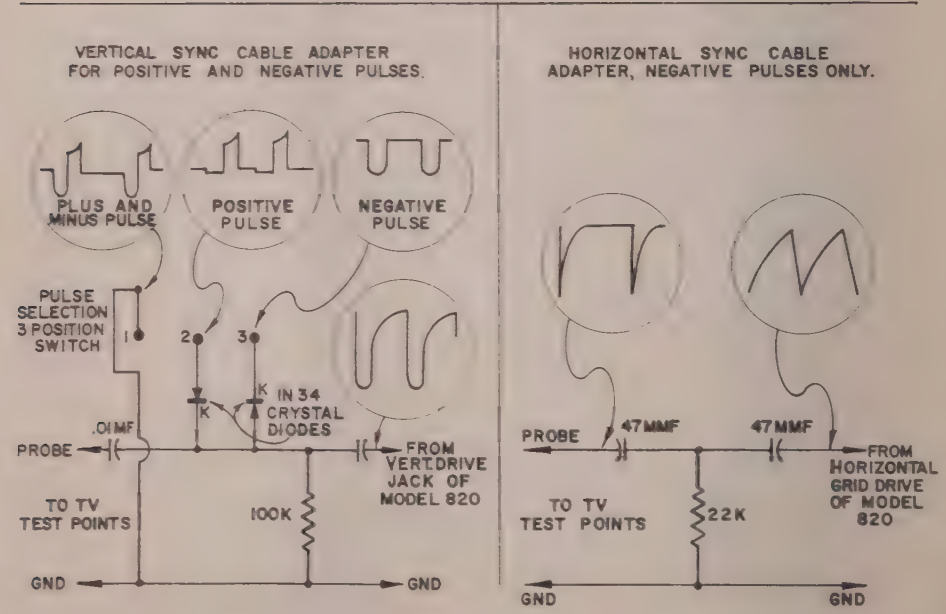
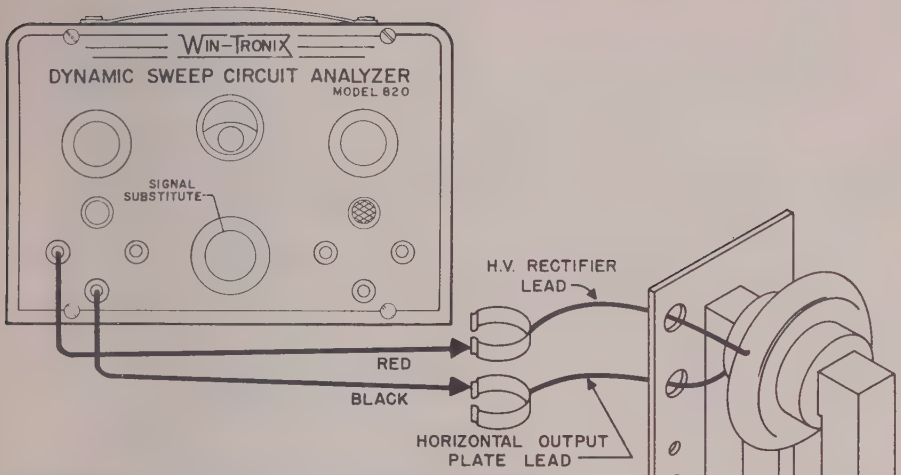
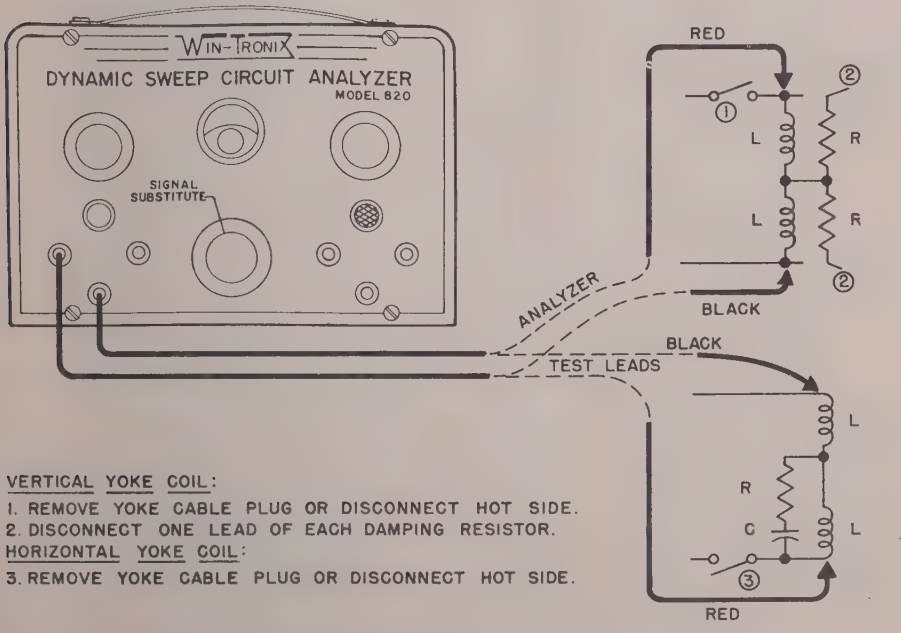


FIG. 4 CABLE ADAPTERS FOR USE WITH MODEL 820 TO PRODUCE SYNC PULSES.



1. REMOVE ALL H.V. RECTIFIER AND DAMPER TUBES.
2. REMOVE YOKE CABLE PLUG OR DISCONNECT THE HOT LEAD.
3. REMOVE PLATE CAP CONNECTOR FROM HORIZONTAL OUTPUT TUBE.
4. UNSOLDER ONE LEAD OF WIDTH COIL.
5. CALIBRATE MODEL 820 AND PROCEED WITH THE TEST (SEE PAGES 10, 11, 12 AND 13).

FIG. 5 HORIZONTAL FLYBACK TRANSFORMER TESTING.



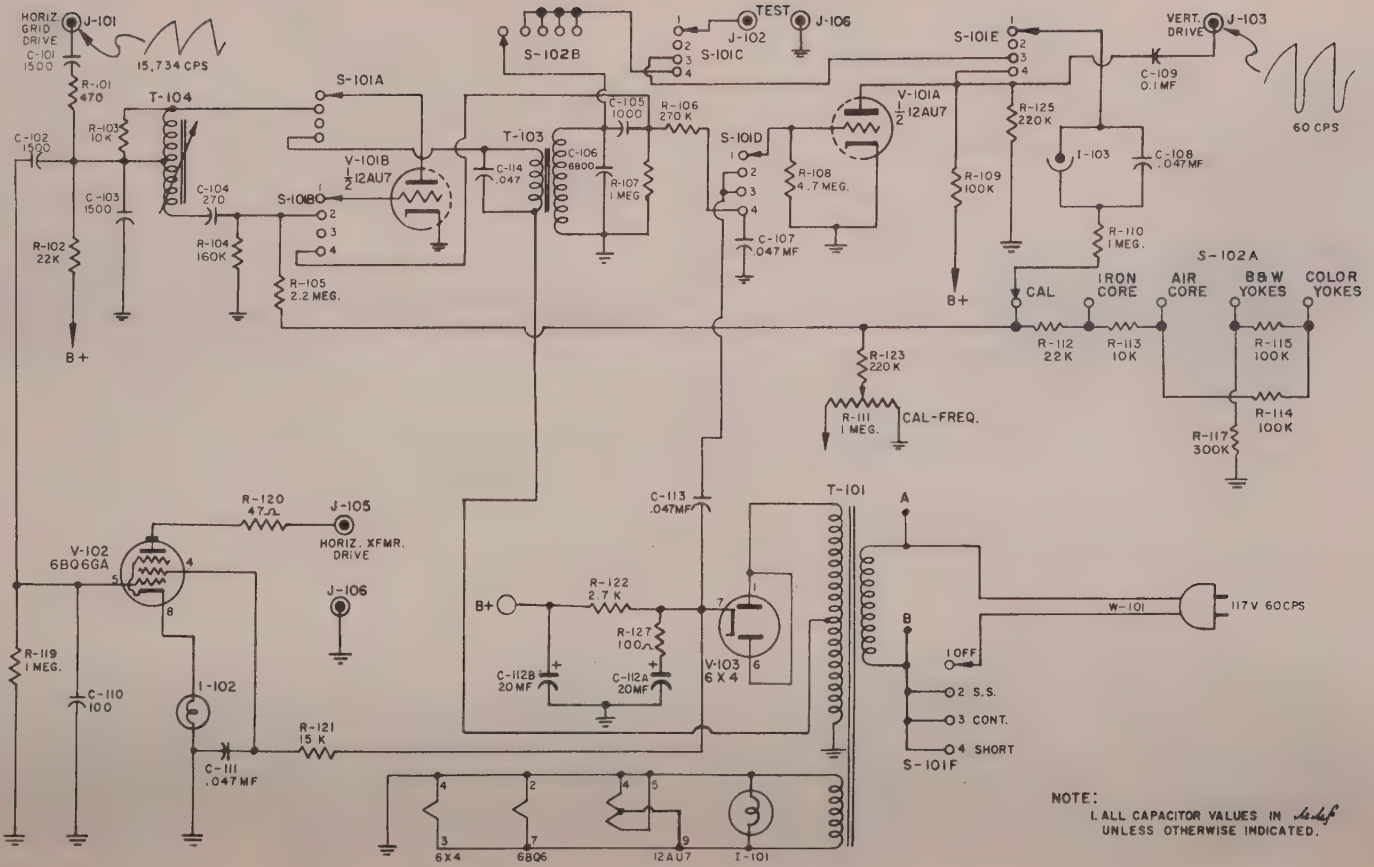
VERTICAL YOKE COIL:

1. REMOVE YOKE CABLE PLUG OR DISCONNECT HOT SIDE.
2. DISCONNECT ONE LEAD OF EACH DAMPING RESISTOR.

HORIZONTAL YOKE COIL:

3. REMOVE YOKE CABLE PLUG OR DISCONNECT HOT SIDE.

FIG. 6 TESTING DEFLECTION YOKES.



NOTE:
1. ALL CAPACITOR VALUES IN mfd UNLESS OTHERWISE INDICATED.

SCHEMATIC DIAGRAM
DYNAMIC SWEEP CIRCUIT ANALYZER
MODEL 820

MODEL 820 PARTS LIST

SYMBOL NO.	DESCRIPTION	PART NO.
C-101, 102, 103	Capacitor, 1500 mmf	104C1-1
C-104	Capacitor, 270 mmf	104C1-4
C-105	Capacitor, 1000 mmf	104C1-5
C-106	Capacitor, 6800 mmf	104C1-6
C-107, 108, 111, 114, 115	Capacitor, .047 mf	104C1-7
C-109	Capacitor, 0.1 mf	104C1-9
C-110	Capacitor, 100 mmf	104C1-10
C-112	Capacitor, 20/20 mf	104C1-12
I-101	Pilot Lamp #51	104I2-3
I-102	Pilot Lamp #44	104I2-4
I-103	Neon Lamp	104I2-5
J-101, 102	Jack, Pin, Red	104J2-6
J-105	Jack, Pin, Black	104J2-7
O-101, 102	Knob, Small	10402-8
O-103	Knob, Large	10402-9
O-104	Escutcheon Plate	10402-10
R-101	Resistor, 470 ohms	104R2-11
R-102	Resistor, 22K, 1W.	104R2-12
R-103, 113	Resistor, 10K	104R2-13
R-104	Resistor, 160K	104R2-14
R-105	Resistor, 2.2 Meg.	104R2-15
R-106, 116	Resistor, 270K	104R2-16
R-107	Resistor, 1 Meg., 5%	104R2-17
R-108	Resistor, 4.7 Meg.	104R3-1
R-109	Resistor, 100K, 1W.	104R3-2
R-110, 111, 119	Resistor, 1 Meg.	104R3-3
R-112	Resistor, 22K	104R3-5
R-114, 115	Resistor, 100K	104R3-7
R-117	Resistor, 300K	104R3-10
R-120	Resistor, 47 ohms	104R3-13
R-121	Resistor, 15K	104R3-14
R-122	Resistor, 2.7K	104R3-15
R-123, 125	Resistor, 220K	104R3-16
S-101	Switch, rotary	A-772-1
S-102	Switch, rotary	A-814
T-101	Transformer, power	C-2180-1
T-103	Transformer, oscillator	C-2181
T-104	Coil, 15KC	B-1354
W-101	Line cord assembly	104W4-7
W-102	Test lead, Black	104W4-8
W-103	Test lead, Red	104W4-9
	Front Panel	B-1356
	Case	C-2159
	Instruction Handbook	IB820-1

NOTES

NOTES

WIN-TRONIX GUARANTEE

Winston Electronics, Inc. warrants instruments manufactured by it to be free from defective material or factory workmanship and agrees to repair such instruments which under normal use and service, discloses the defect to be the fault of our manufacturing. Our obligation under this warranty is limited to repairing any instrument or test equipment which proves to be defective, when returned to us, transportation prepaid, after receipt of factory authorization within ninety (90) days from the date of original purchase and provided the serial number has been made known to us promptly for our records.

This warranty does not apply to any of our products which have been repaired or altered by unauthorized persons or service stations in any way so as, in our judgment, to injure their stability or reliability or which have been subject to misuse, negligence, or accident, or which have had the serial number altered, effaced, or removed. Neither does this warranty apply to any of our products which have been connected, installed, or adjusted otherwise than in accordance with the instructions furnished by us. Accessories, including all vacuum tubes not of our manufacture used in this product, are not covered by this warranty.

This warranty is in lieu of all other warranties expressed or implied and no representatives or persons are authorized to assume for us any other liability in connection with the sale of our products.

Parts will be made available for a minimum period of five (5) years after the manufacture of this equipment has been discontinued. Parts include all materials, charts, instructions, diagrams, accessories, etc., which have been furnished in the standard model.

NOTICE: Upon receipt examine carefully. THIS INSTRUMENT IS INSURED AGAINST DAMAGE IN TRANSIT by the CARRIER. Any claims for damages must be made immediately against that Company. Winston Electronics, Inc. is NOT responsible for nor can it replace or repair any instruments under warranty due to damage in transit.

WINSTON ELECTRONICS, INC.

PHILADELPHIA 27, PA.

Industrial Certification Corp.
P. O. BOX 57
REDONDO, WASH.

RECEIVED
JUN 18 1959

Instruction Book Number IB-820-1

U.S.A.